* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the recording medium which recorded the method of generating music automatically, a program, and such a program and in which computer reading is possible.
[0002]
[Description of the Prior Art]The thing using the chaos character of a fractal figure including the Mandelbrot map other than what generates music automatically combining the music data which carried out user specification out of music data, such as chord data memorized beforehand, is also in the conventional music automatic generation method.
[0003]
[Problem(s) to be Solved by the Invention]However, when generating music automatically combining the music data memorized beforehand, naturally there is a limit in the number of combination. When generating automatically the short music of about 4-8 vibrant tunes especially, for example generating automatically the incoming call notice melody (what is called a ringtone) of portable communication terminals, such as a cellular phone and PHS, there was a problem that the similar music was easy to be generated.
[0004]It is possible by using the chaos character of a fractal figure to expand the width of a variation. However, when a fractal figure etc. were used, there was a problem that a user will need to specify starting point coordinates etc. numerically, and the music generated will turn into music which is called what is called contemporary music or minimal music and which is not good in audibility as for relation.
[0005]This invention is made that such a technical problem should be solved, and is a thing. The purpose does not have the necessity of specifying the numerical value used as the parameter for generation, The music which the similar music is hard to be generated and is

generated further is providing the recording medium which recorded in audibility the music automatic generation method, music automatic generation program, and music automatic generation program which are the good things of relation which are not the style of contemporary music and in which computer reading is possible.

[0006]
[Means for Solving the Problem]The 1st feature of this invention for solving the above-mentioned technical problem, (1) An XY coordinate value acquisition step which acquires X coordinate value and a Y coordinate value of a coordinate point of a predetermined number within a flat surface, (2) a numerical acquisition step corresponding to a coordinate point which acquires a numerical value corresponding to each of a coordinate point of said predetermined number, and (3) -- be in a step which generates a series being included at least by following just because it divided a numerical value corresponding to said coordinate point by the predetermined number of scales, and assigning a sound.
[0007]A "predetermined number" in "a coordinate point of a predetermined number" means here a total of a note which constitutes a series. For example, when it constitutes a series from 128 16 diacritical marks, a "predetermined number" is set to "128", and a "predetermined number" is set to "64" when it constitutes a series from 64 eighth notes.
[0008]"The predetermined number of scales" means the number of scales to be used. Since one octave is usually eight sounds or five sounds (penta tonic scale), when using one octave, the predetermined number of scales is set to "8" or "5", and when using three octaves, "the predetermined number of scales" is set to "24" or "15."
[0009]When using one octave, for example, "it follows just because it divided by the number of scales, and a sound is assigned" means assigning "MI", if remainder which divided a numerical value corresponding to a coordinate point by the number of scales "8" or "5" is "1", remainder is "2" about "DO" and remainder is "3" about "RE."
[0010]In the case of a diatonic scale scale, the number of scales of one octave is set to "7", and, in the case of a chromatic scale scale, it is set to "12."
[0011]The 2nd feature of this invention is said music automatic generation method, and there is in a step which each coordinate point within said flat surface is alike, respectively, and matches a numerical value beforehand further being included.
[0012]The 3rd feature of this invention is said music automatic generation method, and a numerical acquisition step corresponding to said coordinate point reads a picture, and there is in acquiring a numerical value which determines a luminosity of a color of each point which constitutes a picture as a numerical value corresponding to each of said coordinate point.
[0013]RGB data are contained in "a numerical value which determines a luminosity of a color", for example. In the case of 256 color modes, in the case of 8 bit data and 65536 color modes,

it becomes RGB data, and, in the case of 16 bit data and 16,770,000 color modes, becomes 24 bit data.
[0014]The 3rd feature of this invention is said music automatic generation method, and a numerical acquisition step corresponding to said coordinate point has it in acquiring a numerical value corresponding to each coordinate point using a coordinate value and a fractal function of said coordinate point.
[0015]A "fractal function" means a function used in order to draw a fractal figure which has self similarity. Self similarity means character in which it is a reduction figure of the whole figure, when some figures are taken out.
[0016]The Mandelbrot map, the Koch curve, etc. are contained in a "fractal figure."
[0017]The 4th feature of this invention is said music automatic generation method, and said flat surface is a complex plane, and a numerical acquisition step corresponding to said coordinate point, Z(0) =cZ (n) Said X coordinate value and an imaginary part of c have a real part of =Z(n-1)^2+c, however c in said Y coordinate value n asking for operation repeat frequency T until an absolute value of Z (n) expressed with a natural number emits, and making this operation repeat frequency T a numerical value corresponding to said coordinate point.
[0018]An "absolute value" of Z (n) means a square root of the sum of a square of a real part of Z (n), and a square of an imaginary part. "Emission" means that Z (n) exceeds a predetermined value.
[0019]Operation repeat frequency T until an absolute value of Z (n) emits means the numerical value n when an absolute value of Z (n) which repeated an operation, asked for Z (n) one by one, and was called for by doing in this way exceeds a predetermined value like Z+[(1) =Z/ (0) ^2] cZ(2) =Z(1)^2+c:.
[0020]Thus, a series acquired is rich in pitch change, although it is not random.
[0021]The 5th feature of this invention is said music automatic generation method, and said XY coordinate value acquisition step, (1) X coordinate value SX of the starting point within said flat surface, and Y coordinate value SY of the starting point, Delta value DX of the direction of X and the delta value DY of the direction of Y are acquired, (2) starting points are made into the 1st coordinate point, and it is in what (3), and (X coordinate value SX+m* delta value DX of the starting point and the Y coordinate value SY+m* delta value DY of the starting point) are made into the n-th coordinate point for (m and n are natural numbers).
[0022]A coordinate point of a predetermined number which only m* delta value separated from the starting point is acquirable by applying m* delta value to a coordinate value of the starting point.
[0023]A step which the 6th feature of this invention is said music automatic generation method, and acquires (1) character string further, (2) A step which changes said character string into a character code string by changing into a character code each character which constitutes said

character string, (3) A step which generates the 1st bit string from said character code string by changing into a bit string each alphanumeric character which constitutes said character code string, (4) A step which generates two or more numerical values V1, V2, V3, and V4 by changing into a numerical value each of two or more 2nd bit strings produced by extracting two or more bits from said 1st bit string, (5) Be in a step which generates said two or more numerical values V1, V2, V3, said SX from V4, SY, DX, and DY being included.
[0024]As a formula which generates a numerical value (SX, SY, DX, DY) from a numerical value (V1, V2, V3, V4), For example, SX=-2.0+V1/0x10000*4.0SY=-2.0+V1/0x10000*4.0DX=1/(V3+10) DY=1/(V4+10) etc. are mentioned.
[0025]A numerical value (SX, SY, DX, DY) suitable for generating music automatically using the 5th feature can be acquired from arbitrary character strings according to such 6th feature. If a delta value (DX, DY) is too small, below an effective digit number of a floating point will become, and it will be substantially processed as "0." If a delta value (DX, DY) is small even if not processed as "0", an interval of a coordinate point acquired will be too narrow, and a numerical value corresponding to each coordinate point will approximate. For this reason, a sound acquired will approximate and monotonous music which the same sound follows will be generated. However, if a coordinate point of a predetermined number is acquired using a numerical value (SX, SY, DX, DY) acquired by the 6th feature, music generated from a numerical value corresponding to an acquired coordinate point will serve as a musical piece with a motion which is not monotonous.
[0026]A step (2) from which the 7th feature of this invention acquires X coordinate value SX of the starting point in (1) complex plane, Y coordinate value SY of the starting point, delta value DX of the direction of X, and the delta value DY of the direction of Y,
Z(0) =cZ (n) Step (3) which asks for operation repeat frequency T until, as for a real part of =Z (n-1)^2+c, however c, an absolute value of Z (n) to which Y coordinate value SYn of the starting point is expressed with a natural number emits an imaginary part of the X coordinate values SX and c of the starting point,
Z(0) =cZ (n) A real part of =Z(n-1)^2+c, however c is an imaginary part (Y coordinate value SY+m* delta value DY of the starting point) of the X coordinate value SX+m* delta values (DX) and c of the starting point.
A step which asks for operation repeat frequency T until an absolute value of Z (n) expressed with a natural number emits m and n, and a step (5) which acquires a numerical value not more than more than (4) 0.01 0.99, and sets this figure to X (0),
X(n) = lambda*X (n-1) (1-X (n-1))
However, lambda calculates X (n) to which less than four positive-number n is expressed with a natural number one by one, a step which computes X (n) each, and (6) -- with ****** [the number of said each operation repeat frequency T / odd]. A step which judges size relation

with a threshold beforehand set to said X (n), (7) Be in a step which generates a rhythm being included at least based on a decision result of being said odd number, and a decision result of said size relation by assigning either "note one (a sound is sounded)", "continuing a front sound" or a "rest."

[0027]Thus, although a generated rhythm is chaos-like, it has behavior of not being random. Thereby, a rhythm which was fully varied is generated. A physical random number from which the same result is not obtained even if it will say having the character of an arithmetic random number that the same result is obtained and will start from the same initial value, if it starts from the same initial value as "not random" means differing.

[0028]A logistic function, the Romer method, a method in ******, the digital chaos method, the Mersenne twistor method, a hash function, a tentorium function, etc. are included in an arithmetic random number.

[0029]the 8th feature of this invention is said music automatic generation method -- further -- (1) -- a step (2) which adds 0.01 to a value which broke Vsaid numerical value V1, V2, V3, or 4 by the maximum which these figures can take, and generates the numerical value X (0),

X(n) = lambda*X (n-1) (1-X (n-1))

However, lambda calculates X (n) to which less than four positive-number n is expressed with a natural number one by one, a step which computes X (n) each, and (3) -- with ****** [the number of said each operation repeat frequency T / odd]. A step which judges size relation with a threshold beforehand set to said X (n), (4) Be in a step which generates a rhythm being included at least based on a decision result of being said odd number, and a decision result of said size relation by assigning either "note one (a sound is sounded)", "continuing a front sound" or a "rest."

[0030]Thus, generated music becomes that to which a sound and a rhythm were varied.

[0031]

[Embodiment of the Invention]Hereafter, an embodiment of the invention is described with reference to drawings.

[0032]Drawing 1 is a flow chart which shows the outline of processing of the music generation method concerning an embodiment of the invention. As shown in drawing 1, the music generation method concerning an embodiment of the invention generates a numerical value from a character string, generates a series and a rhythm further, finally applies a rhythm to a series and generates music. Hereafter, each processing is explained concretely.

[0033](A) The generation drawing 2 of a character string to a numerical value is a flow chart which shows the contents of the processing which generates a numerical value from a character string. As shown in drawing 2, a character string is first changed into a character code string (Step S110), and then a bit string is generated from a character code string (Step S120), and a numerical value is generated from a bit string (Step S130).

[0034](A-1) Change a character string into a character code string (Step S110).
In order to change a character string into a character code string, the character code table showing the correspondence relation between a character and a character code is required. And a character string is changed into a character code string by dividing a character string into each character and repeating the processing which investigates the character code which corresponds with reference to a character code table about each character.
[0035]Drawing 3 is a figure showing the correspondence relation between a character string and a character code string. A character string is an example of "playback Part2" and drawing 3 changes each character into the shifted JIS code or an ASCII code. That is, to "8376" "I" for "RE" at "838C" to "8343". ["PU"] "BA" -- "836F" -- "TSU" -- "8362" -- "KU" -- "834E" -- "" (en space) -- "20" -- "P" -- "50" -- "a" -- "61" -- "t" is changed into "74" and "2" is changed into "72" for "r" "32", respectively. Thus, the code string "8376 838C 8343 836F 8362 834E 20 50 61 72 74 32" is obtained from a character string "playback Part2."
[0036](A-2) Generate a bit string from a character code string (Step S120).
A 4-bit bit string is generated from each alphanumeric character (0-9, and A-F) which constitutes a character code. That is, "1" to "0001" is generated for "0" to "0000", and "1111" is generated for "2" to "0010" from ... "F."
[0037]Under the present circumstances, since a bias is among the alphanumeric characters which appear in a character code string, it is preferred to carry out processing which lessens this bias.
[0038]For example, the top alphanumeric character "8" of the shifted JIS code, "9", or "E" will be removed and packed.
[0039]When drawing 4 generates a bit string from a character code string, it is a figure showing an example of the processing which lessens an alphenumeric bias. As shown in drawing 4, the frequencies of occurrence, such as "8", are lessened by "8376" being set to "376", setting "838C" to "38C", setting "8343" to "343", setting "836F" to "36F", setting "8362" to "362", and setting "834E" to "34E."
[0040]Then, each character alphanumeric string is changed into a bit string. That is, set "376" to "001101110110" and "38C" is set to "001110001100", "343" is set to "001101000011", "36F" is set to "001101101111", "362" is set to "001101100010", and "34E" is set to "001101001110."
[0041]Since the most significant bit at the time of changing each numerical value of an ASCII code into an 8-bit bit string is always "0", it lessens the frequency of occurrence of "0" by removing and packing this. That is, "20" is set to "0100000" through "00100000", Set "50" to "1010000" through "01010000" and "61" is set to "1100001" through "01100001", pass "01110010" in "72" -- be referred to as "1110010" and pass "01110100" in "74" -- be referred to as "1110100" and pass "00110010" in "32" -- it is referred to as "0110010." Thus, from a

character code string "8376 838C 8343 836F 8362 834E 2050 61 72 74 32." A bit string "0011011101100011100011000011010000110011011011110011011000100011010011100 10 **********.

[0042](A-3) generate a numerical value from a bit string (Step S130)

Next, four numerical values (V1-V4) are generated from a bit string. When the bit string generated from the code string is 64 bits or more, from the most significant bit or a least significant bit, it may divide every 16 bits and four 16-bit bit strings may be generated.

[0043]When the bit string generated from the code string is less than 64 bits, after complementing "0" and considering it as a 64-bit bit string, it may divide every 16 bits.

[0044]From the most significant bit or the least significant bit of a 64-bit bit string, 16 bits may be extracted at intervals of 4 bits, and four 16-bit bit strings may be generated.

[0045]16 bits are extracted to drawing 5 at intervals of 4 bits from a 64-bit bit string, a 16-bit bit string is generated to it, and an example of the processing which acquires the numerical value V is shown in it.

[0046]As shown in drawing 5 (a), from a bit string "0011011101100011100011000011010000110011011011110011011000100011." The 1st the "0", the 5th the "0", the 9th the "0", the 13th the "0", The 17th the "1", the 21st the "1", the 25th the "0", the 29th the "0", The 33rd the "0", the 37th the "0", the 41st the "0", the 45th the "1", the 49th the "0", the 53rd the "0", the 57th the "0", and the 61st the "0" are extracted, and the bit string "0000110000010000" is generated. And the numerical value V1 is acquired from the obtained bit string.

[0047]Similarly as shown in drawing 5 (b), from a bit string "0011011101100011100011000011010000110011011011110011011000100011." The 2nd the "0", the 6th the "1", the 10th the "1", the 14th the "0", The 18th the "0", the 22nd the "1", the 26th the "0", the 30th the "1", The 34th the "0", the 38th the "0", the 42nd the "1", the 46th the "1", the 50th the "0", the 54th the "1", the 58th the "0", and the 62nd the "0" are extracted, and the bit string "0110010100110100" is generated. And the numerical value V2 is acquired from the obtained bit string.

[0048]It is desirable in order for the whole to change, if the direction extracted and generated at intervals of 4 bits changes at least one mere copy of a character string.

[0049]Thus, four numerical values (hereafter referred to as V1, V2, V3, and V4.) are generated.

[0050](B) Generate a series from a numerical value (Step S200).

Drawing 6 is a flow chart which shows the flow of the processing which generates a series from a numerical value. As shown in drawing 6, a numerical value (SX, SY, DX, DY) is first acquired from a numerical value (V1, V2, V3, V4) (Step S210). SX and SY express the X coordinate and Y coordinate of the starting point, respectively, and DX and DY express the

increment of the direction of X, and the increment of the direction of Y, respectively.
[0051]Next, 128 repeat frequency T is calculated from a numerical value (SX, SY, DX, DY) (Step S220). It asks for repeat frequency T about the starting point (SX, SY) first, and then asks for repeat frequency T about the 2nd point (SX+DX, SY+DY). It asks for repeat frequency about the 128th point (SX+127*DX, SY+127*DY) like the following.
[0052]Finally, 128 sounds are searched for from 128 repeat frequency T (Step S230). The concrete contents of each step are explained.
[0053](B-1) Acquire a numerical value (SX, SY, DX, DY) from a numerical value (V1, V2, V3, V4) (Step S210).
For example, four numerical values (SX, SY, DX, DY) are acquired from four numerical values (V1, V2, V3, V4) using a following formula.
[0054]
SX=-2.0+V1/0x10000x4.0SY=-2.0+V2/0x10000x4.0DX=1/(V3+10)
DY=1/(V4+10)
The starting point (SX, SY) enters into the quadrangle surrounded by (-2, -2), (-2, 2), (2, 2), and (2, -2). That is, they are 2>=|X| and 2>=|Y|. The starting point shall be gone into this range in order that the absolute value of Z (n) may keep in emission very much by small repeat frequency out of this range. For example, if it is |X|>=3 and |Y|>=3, it will emit by Z (5) grade. That is, repeat frequency will always be set to "5" and the music generated will become monotonous.
[0055](B-2) Calculate 128 repeat frequency T from a numerical value (SX, SY, DX, DY) (Step S220).
It asks for repeat frequency T about 128 coordinate points using fractal functions, such as the Mandelbrot function.
[0056]Specifically The starting point (SX, SY), the 2nd point (SX+DX, SY+DY), the 3rd point (SX+2*DX, SY+2*DY) and ... it asks for repeat frequency T of a recurrence formula until Mandelbrot value-of-a-function |Z| exceeds a predetermined value about each point of the 128th point (SX+127*DX, SY+127*DY).
[0057]The processing which uses the Mandelbrot function for drawing 7 and asks it for repeat frequency T about starting point coordinates (SX, SY) is shown.
[0058]First, it asks for operation repeat frequency until the Mandelbrot value of a function emits about the starting point (SX, SY) (Step S310).
[0059]Generally, the Mandelbrot function is Z(n) =Z(n-1)^2+c (n is a natural number).
It comes out and the recurrence formula with which it is expressed is said. c is c=a+ib (a and b are the real numbers, and a is called real part and they call b an imaginary part.). i is a square root of -1. It is expressed. The square root of (a^2+b^2) is called absolute value of c, and it expresses |c|.

[0060]In this embodiment, if the X coordinate (SX) of the starting point is used as the real part of the complex number c, and the Y coordinate (SY) of the starting point is used as an imaginary part and |Z| exceeds 2, it will be regarded as "emission."
[0061]As shown in drawing 7, specifically, it is Z(0) =SX+iSYZ(1) =Z(0)^2+Z (0).
Z(2)=Z(1)^2+Z(0)
::Z(n)=Z(n-1)^2+Z(0
It is investigated whether it asked for Z (n) one by one so that it might say, and |Z(n) | exceeded 2 each about Z (n). | Set n when Z(n) | exceeds 2 to operation repeat frequency T until it emits. Even if it repeats 400 calculations, when not emitting, it is considered as the repeat frequency T= 400.
[0062]Thus, it asks for repeat frequency T about (SX, SY).
[0063]Next, it asks for repeat frequency T about the 2nd point (SX+DX, SY+DY).
[0064]The formula which asks for the operation repeat frequency to emission is shown in drawing 8 (a) about the coordinates (SX+DX, SY+DY) which added increment to the starting point (SX, SY).
[0065]As shown in drawing 8 (a), it is Z(0) =(SX+DX)+i (SY+DY).
Z(1)=Z(0)^2+Z(0)
Z(2)=Z(1)^2+Z(0)
::Z(n)=Z(n-1)^2+Z(0
It is investigated whether it asked for Z (n) one by one so that it might say, and |Z(n) | exceeded 2 each about Z (n). | Set n when Z(n) | exceeds 2 to operation repeat frequency T until it emits. Even if it repeats 400 calculations like the starting point (SX, SY), when not emitting, it is considered as the repeat frequency T= 400.
[0066]About each of two coordinates of starting point coordinates (SX, SY) and the 2nd coordinates (SX+DX, SY+DY), operation repeat frequency T can be found so far.
[0067]As shown in drawing 8 (b), 128 repeat frequency T is obtained by attaching by the 128th point (SX+127*DX, SY+127*DY) from the 3rd point (SX+2*DX, SY+2*DY) still more nearly similarly, and asking for repeat frequency. It asks to the 128th because one track is constituted from 128 16 diacritical marks.
[0068]When the number of the sounds which constitute one track is fluctuated, the number of needed repeat frequency T is also fluctuated.
[0069]Repeat frequency [about the n-th coordinates (Xn Yn)] T (n), When repeat frequency T about coordinates (Xn+DX, Yn+DY) which added increment (DX, DY) to the n-th coordinates becomes the same value, It is preferred to set to T (n+1) repeat frequency T for which it asked about the coordinates (Xn+2*DX, Yn+2*DY) which added the twice of increment (DX, DY) to the n-th coordinates.
[0070]Repeat frequency [about the n-th coordinates (Xn Yn)] T (n), When repeat frequency T

about coordinates (Xn+2*DX, Yn+2*DY) which added the twice of increment (DX, DY) to the n-th coordinates becomes the same value, it is preferred to repeat addition of increment (DX, DY) until different repeat frequency T is obtained. That is, it asks for repeat frequency T about each of (Xn+2*DX, Yn+2*DY), (Xn+3*DX, Yn+3*DY), (Xn+4*DX, Yn+4*DY), and ... until different repeat frequency T is obtained.

[0071]Repeat frequency [about the n-th coordinates (Xn Yn)] T (n), When repeat frequency T about coordinates (Xn+2*DX, Yn+2*DY) which added the twice of increment (DX, DY) to the n-th coordinates has the same value, it is more preferred to repeat twice as many addition as increment (DX, DY) until different repeat frequency T is obtained. That is, it asks for repeat frequency T about each of (Xn+2*DX, Yn+2*DY), (Xn+4*DX, Yn+4*DY), (Xn+6*DX, Yn+6*DY), and ... until different repeat frequency T is obtained. By enlarging increment, it becomes possible to decrease the total of required calculation, by the time it obtains different repeat frequency T.

[0072]The new coordinates acquired by adding increment (DX, DY), When coming out of the quadrangle surrounded by four points, (2.0, 2.0), (2.0, -2.0), (-2.0, 2.0), and (-2.0, -2.0), As shown in drawing 9, it is preferred to carry out processing called a wrap around (it will move to the lower side if the top chord is overflowed, and it will move to the left side if the right-hand side is overflowed).

[0073](Formation of many voice) In addition, although generation by a single sound is also materialized as music, since musical width spreads to consider it as "the music which bears for hearing it", for it, two or more sounds are more preferred.

[0074]"The music which bears for hearing it" is the music which there is sufficient pitch change and had a sufficiently [in rhythm] more complicated still melody. Unless two or more melody becomes cacophony, such as short 2 degree, if a main melody is emphasized or Risumic hears a motion of melody other than a main melody, it can be said by being put together well involving each melody as much as possible that it is much more musical.

[0075]For example, it asks for the 2nd 128 repeat frequency for tracks by repeating the same processing as the above for the point which only the predetermined value separated from the terminal point (SX+127*DX, SY+127*DY) of the 1st track as the starting point of the 2nd track. The same processing is repeated and it asks for the 3rd to the 8th 128 repeat frequency for tracks.

[0076]If the coordinates of the terminal point of the m-th track and the starting point of the track of eye watch (m+1) are close, The sequence-of-numbers pattern of the m-th track and the sequence-of-numbers pattern of the track of eye watch (m+1) will be alike, and, as a result, the pattern of the series of the m-th track and the series of the track of eye watch (m+1) will be alike. Here, m is seven or less natural number.

[0077]On the other hand, if the coordinates of the terminal point of the m-th track and the

starting point of the track of eye watch (m+1) separate too much, The relevance of the sequence-of-numbers pattern of the m-th track and the sequence-of-numbers pattern of the track of eye watch (m+1) will become thin, and, as a result, the relevance of the pattern of the series of the m-th track and the series of the track of eye watch (m+1) will become thin.
[0078]Then, it is preferred to determine the interval of the starting point of the m-th track and the starting point of the track of eye watch (m+1) as follows. It is preferred to perform the following processings about each of an X coordinate and a Y coordinate.
[0079]When the value produced by dividing (The end coordinate of the m-th track - the starting point coordinates of the m-th track) by 10 is smaller than 0.01, let the obtained value be an interval of the terminal point of the m-th track, and the starting point of the track of eye watch (m+1) as it is.
[0080]When the value produced by dividing by 10 is larger than 0.01, it divides by 7 until it becomes smaller than 0.01.
[0081]Although the series generated from an adjoining track is alike, it is preferred that it is different for a while. If the series generated from an adjoining track is widely different too much, it will be music without a settlement. If the starting point of an adjoining track approaches too much, the series generated from both tracks becomes the same, and is not preferred.
[0082]It was presupposed that (The end coordinate of the m-th track - the starting point coordinates of the m-th track) are divided by "10." However, it is possible to generate the series "is different for a while although it is alike" even if it breaks by the numerical value not only between "5" and "10" but "50." However, "10" is preferred for the reason for being computable in a short time.
[0083]When the value produced by dividing by 10 was larger than 0.01, it was presupposed that it divides by "7" until it becomes smaller than 0.01. However, the series "is different for a while although it is alike" even if it divides "not only 7" but except "10" for other numerical values (for example, "5-15") near "10" can be acquired.
[0084]comparing all the tracks, if it all comes out and the sequence of numbers for eight tracks is acquired -- "the sequence of numbers corresponding to the series which constitutes the 1st vibrant tune of a certain track" -- "-- others -- when sequence-of-numbers" corresponding to the series which constitutes the 1st vibrant tune of a track is thoroughly in agreement, re-calculating, after performing the following operations is preferred.
[0085]for example, the terminal point of the m-th track -- increment -- not being related (0, 0) -- it carries out. And the interval of the terminal point of the m-th track and the starting point of the track of eye watch (m+1) is set to (starting point [The terminal point of the m-th track -] of m-th track) *2/10. However, when (starting point [The terminal point of the m-th track -] of m-th track) *2/10 are smaller than 0.001, it restricts.
[0086](B-3) Generate a sound from each repeat frequency T (Step S230).

When changing each repeat frequency into a sound, the scale to be used is defined beforehand and consecutive numbers are given to each sound. And the sound to which the number equal to the surplus obtained by dividing each repeat frequency by the total number of a scale is given is carried out [sound / of each repeat frequency].

[0087]The example which assigns each sound of "do, re, mi, fa SORASHI" to repeat frequency T is shown in drawing 10. If the remainder which divided repeat frequency T by 7 is "0" as shown in drawing 10, it is "DO" and "1", it is "RE" and "2", it is "MI" and "3", it is "FA" and "4", it is "SO" and "5" and it is "RA" and "6", it assigns like "Si."

[0088]When it assigns in this way, if 1st repeat frequency T (0) is "70", the 1st sound "DO", If 2nd repeat frequency T(1) G is "71", the 2nd sound "RE", if 3rd repeat frequency T (2) is "72" and "MI", ..., 100th repeat frequency T (99) of the 3rd sound are "350" -- the 100th sound -- "DO" and ... if 128th repeat frequency T (127) is "286", the 128th sound serves as "Si."

[0089](C) The generation drawing 11 of a rhythm is a flow chart which shows the numerical value V1 and the flow of the processing which generates a rhythm using repeat frequency T (0) - T (127). Instead of the numerical value V1, Vthe numerical value V2, V3, or 4 may be used.

[0090]As shown in drawing 11, the 128 numerical values X (0) - X (127) are first generated from the numerical value V1 (Step S310), 128 commands which direct note one, continuation of a last sound, or either of the rests after that from these figures X (0) - X (127) and repeat frequency T (0) - T (127) are generated (Step S320). Hereafter, it explains concretely.

[0091](C-1) Generate the 128 numerical values X (0) - X (127) from the numerical value V1 (Step S310).

In the sequence of numbers X (n) (n is a natural number), the relation between X (n) and X (n+1) is X(n+1)= lambda*X (n) * (1-X (n)). When given by 0<=lambda<=4, such a sequence of numbers is called logistic model. This sequence of numbers takes an irregular value. That is, chaos behavior is carried out.

[0092]For example, it is referred to as lambda= 3.98, and the initial value X (0) of X (n) reuses said V1, and sets it to X(0) =0.01+0.98*V1/65535. In this formula, if it is V1=0, it is set to X(0) =0.01, and if it is V1=65535 (maximum which can be expressed by 16 bits), it is set to X(0) =0.99.

[0093]The example which uses a logistic function and calculates X (n) one by one is shown in drawing 12. As shown in drawing 12 (a), X (0) is first calculated from X(0) =0.01+0.98*V1/65535. Next, this X (0) is substituted for X(1) = lambda*X (0) * (1-X (0)), and X (1) is calculated. Like the following, calculation is successively repeated with X*[(2) = lambda*X / (1)] (1-X (1))::X(126)= lambda*X (125) *(1-X (125))X(127)= lambda*X (126) * (1-X (126)), and the numerical values from X (0) to X (127) are calculated.

[0094]Temporarily, it is X(0)=0.01+0.98*100/65535=0.01149538414X(1)

=3.98*0.01149538414*(1-0.01149538414)=0.04522569632X(2)=3. when lambda= 3.98 and V1=100. It becomes 98*0.04522569632*(1-0.04522569632)=0.17185772419X(3) =3.98*0.17185772419*(1-0.17185772419)=0.56644413436:.

[0095]When lambda is made into constant value and V1 is made into or more 0 65535 or less integer on the other hand, the value which X (0) can take is limited to 65536 kinds. For this reason, the sequence of numbers to X (127) produced each from X (0) by calculating one by one will also be limited to 65536 kinds.

[0096]If a sequence of numbers is limited to 65536 kinds, the probability that the same rhythm will be generated will become high. In order to lower the probability that the same rhythm will be generated, That is, in order to raise the probability that a different rhythm will be generated, It is preferred to repeat each X (0) to N times calculation, to calculate X (N), to repeat this X (N) to 127 more times calculation, to calculate the numerical value to X (N+127), and to generate a rhythm using 128 numerical values from these [X] (N) to X (N+127).

[0097]The example which repeats X (0) to N times calculation, asks drawing 12 (b) for X (N), repeats this X (N) to 127 more times calculation to it, and asks it for the numerical values from X (N) to X (N+127) is shown.

[0098]it is shown in drawing 12 (b) -- as -- X(0) =0.01+0.98*V -- the calculation 1 / 65535X(1) = lambda*X (2) = lambda*X (1) *(1-X (1)):X(N) = lambda*X (N-1) * (1-X (N-1)) is repeated, and X (N) is calculated. [(0) *(1-X (0))X] and, Further X. (N+1) = lambda*X (N) the calculation *(1-X (N)) X(N+2)=lambda*X(N+1) *(1-X (N+1)):X(N+126)=lambda*X(N+125) *(1-X (N+125)) X (N+127)=lambda*X(N+126) * (1-X (N+126)). Repeatedly, each numerical value from X (N) to X (N+127) is calculated. Thus, 128 X for one track (n) can be found.

[0099]Let the above-mentioned numerical value N be the value which added altogether 7 bits (with no distinction of ASCII/full width) of low ranks of the character string inputted, for example. That is, when the inputted character string is "abc", the character codes of each character are 65, and "66, 67." These each character code is changed into a bit string, and the value which added 7 bits of low ranks altogether is set to "198."

[0100]Temporarily, it is X(0)=0.01+0.98*100/65535=0.01149538414X(1) =3.98*0.01149538414*(1-0.01149538414)=0.04522569632X(2)=3. when V1=100. The calculation 98*0.04522569632*(1-0.04522569632)=0.17185772419X(3) =3.98*0.17185772419*(1-0.17185772419)=0.56644413436:. X (198) is calculated repeatedly 198 times. And the values of each X (n) from X (198) to X (198+127) are calculated by repeating 127 calculations further.

[0101](C-2) Generate a rhythm from 128 repeat frequency T and the 128 numerical values X (Step S320).

Based on 128 repeat frequency T (0) obtained using the Mandelbrot function - T (127), and the 128 numerical values X (0) acquired using the logistic function - X (127), either "note one",

"continuation" or a "rest" is determined.
[0102]For example, with odd number, if X (n) is larger than a threshold as for 1 repeat-frequency T (n), it will consider it as "note one (a sound is sounded)", and with odd number, 2 repeat-frequency T (n) considers a front sound as "continuation", when X (n) is below a threshold. However, if there is no sound in front, it will be considered as "note one", with even number, if X (n) is larger than a threshold as for 3 repeat-frequency T (n), it will consider it as "note one", and with even number, 4 repeat-frequency T (n) considers it as a "rest", when X (n) is below a threshold.
[0103]Drawing 13 is a flow chart which shows the flow of the processing which generates a rhythm based on repeat frequency T and the numerical value X.
[0104]As shown in drawing 13, repeat frequency T (n) judges odd number or even number first (Step S321).
[0105]When the number of repeat frequency T (n) is odd, it is judged whether X (n) is larger than a threshold or small (Step S322). X (n) considers it as note one, when larger than a threshold. X (n) judges whether a sound is in front further / whether there is nothing, when smaller than a threshold (Step S323). When a sound is in front, a front sound is continued, and when there is no sound in front, it is considered as note one.
[0106]Also when the number of repeat frequency T (n) is even, it is judged whether X (n) is larger than a threshold or small (Step S325). X (n) judges whether a sound is in front further / whether there is nothing, when larger than a threshold (Step S326). When a sound is in front, a front sound is continued, and when there is no sound in front, it is considered as note one. X (n) considers it as a rest, when smaller than a threshold.
[0107](D) At the last which applies a rhythm to a series and generates music, apply the already generated rhythm to the already generated series, and create music.
[0108]An example of the processing which applies a rhythm to a series and generates music is shown in drawing 14. In the example shown in drawing 14, when "note one" is presupposed that "0" and "continuation of a front sound" are expressed as "1", and a "rest" is expressed as "2", suppose that the generated rhythm is expressed with "00102002010221011121012010." When "C" considers it as "DO" and "D" presupposes that in "MI" and "F" "FA" and "G" express "SO", "A" expresses "RA", and "B" expresses ["RE" and "E"] "Si", suppose that the generated series is expressed with "CBFGECDBFCFDGCDFAADCBDEFG."
[0109]That is, 00102002010221011121012010 [a rhythm] is written and CBFGECDBFCFDGCDFAADCBDEFG [a series] is written.
[0110]And it is CB-G_CD_F-F__CD when said rhythm is applied to said series. -- Music called _DC-_E-G is obtained.
[0111]Supposing it assigns note one, continuation, and a rest every 16 diacritical marks, "C 16 diacritical marks", "B eighth note", "G 16 diacritical marks", a "16-minute rest", "C 16 diacritical

marks", "D 16 diacritical marks", a "16-minute rest", "F eighth note", "F16 diacritical marks", The music which consists of an "8-minute rest", "C 16 diacritical marks", "D dotted eighth note", a "16-minute rest", "D 16 diacritical marks", "C eighth note", a "16-minute rest", an "E eighth note", and "G 16 diacritical marks" is obtained.

[0112]As explained above, according to the embodiment of the invention, generating a numerical value from a character string, generating a series, generating a rhythm, and music are generable.

[0113]Thus, since it has the character in which the same result is obtained from the same initial value, it is not random, but the series generated is rich in pitch change.

[0114]A series cannot be generated from a character string but a series can also be generated from the existing image data. For example, it is good though it responds just because it divided by the number of scales (for example, "36") which acquires two or more coordinate points from on the picture expressed by the (1) 256 kind color, acquires the color data (numerical value of 0-255) corresponding to (2) each coordinate point, and uses the numerical value of the color data by which (3) acquisition was carried out, and a sound is assigned.

[0115]Thus, although it is not random, the rhythm generated has chaos behavior and is fully varied.

[0116]Since a logistic function has the feature that (1) (2) by which same result is obtained from same initial value calculation is easy, it is preferred.

[0117]A complicated formula may be used when saying that such a highly efficient computer that calculation may take time, or calculation can be completed in an instant even if it uses a complicated equation can be used. For example, the same result is obtained even from the following formula which quantized so that Y (t) obtained using in phase transformation Y(t) = {2/pi/sinrootx (t)} for which it asked from the function showing a tentorium map might become an integral value.

[0118]2/Y(t) =[{pi/sinrootx (t)} *2^n] In addition, [] means the processing which omits below a decimal point.

[0119]It is good, though the numerical value corresponding to each coordinate point is not computed using expression, but the numerical value corresponding to each coordinate value is beforehand decided from each coordinate value and this figure is read.

[0120]Thus, the music generated has sufficient pitch change and has a sufficiently [in rhythm] complicated melody. Unless further two or more melody becomes cacophony, such as short 2 degree, a main melody is emphasized because it is put together well involving each melody as much as possible, or a motion of melody other than a main melody is ******** to Risumic.

[0121]Although it was used SX=-2.0+V1/0x10000*4.0 in the above-mentioned embodiment as a formula which generates X coordinate value SX of the starting point from V1, it is a

$$F'(X) = \lim_{h \to 0} (F(X+h) - F(X)) / h$$

differential function instead of V1/0x10000.

It may use. "h->0" is taken as |h|=1-/n (n is a natural number).

[0122]In order to acquire 128 coordinate points, increment (DX, DY) was added to the starting point (SX, SY) one by one. However, secondary functions other than the method of using such a primary function, such as Y=a*X^2, may be used.

[0123]the function which used pi when it was made a program which searches for the range into the circumference -- also using it -- it is good. What differentiated the function may be used.

[0124]

[Effect of the Invention]According to this invention, a numerical value can be acquired from two or more coordinate points, and a sound can be generated from each numerical value.

[0125]The coordinate point, increment, and fractal function of (1) complex plane to a series, (2) A rhythm from the coordinate point, the increment, fractal function, and logistic function of a complex plane, (3) And the recording medium which recorded the method of generating music combining a series and a rhythm, the program to generate, and such a program and in which computer reading is possible is realizable.

[0126]The recording medium which recorded the method of generating the coordinate point and increment of a complex plane required for generation of such a series and a rhythm from a character string, the program to generate, and such a program and in which computer reading is possible is also realizable.

[Translation done.]